STUDIJŲ KOKYBĖS VERTINIMO CENTRAS

Vilniaus Gedimino technikos universiteto

STUDIJŲ PROGRAMOS *GAMYBOS INŽINERIJA IR VALDYMAS* *(valstybinis kodas - 612H77001)* VERTINIMO IŠVADOS

EVALUATION REPORT OF *PRODUCTION ENGINEERING AND MANAGEMENT* (*state code - 612H77001*) STUDY PROGRAMME

at Vilnius Gediminas Technical University

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Išvados parengtos anglų kalba
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DUOMENYS APIE ĮVERTINTĄ PROGRAMĄ

Studijų programos pavadinimas	***Gamybos inžinerija ir valdymas***
Valstybinis kodas	612H77001
Studijų sritis	Technologijos mokslai
Studijų kryptis	Gamybos inžinerija
Studijų programos rūšis	Universitetinės studijos
Studijų pakopa	Pirmoji
Studijų forma (trukmė metais)	Nuolatinė (4)
Studijų programos apimtis kreditais	240
Suteikiamas laipsnis ir (ar) profesinė kvalifikacija	Gamybos inžinerijos bakalauras
Studijų programos įregistravimo data	2001

INFORMATION ON EVALUATED STUDY PROGRAMME

Title of the study programme	***Production Engineering and management***
State code	612H77001
Study area	Technological Sciences
Study field	Production and Manufacturing Engineering
Type of the study programme	University studies
Study cycle	First
Study mode (length in years)	Full-time (4)
Volume of the study programme in credits	240
Degree and (or) professional qualifications awarded	Bachelor of Manufacturing Engineering
Date of registration of the study programme	2001

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I. INTRODUCTION

1.1. Background of the evaluation process

The evaluation of on-going study programmes is based on the **Methodology for evaluation of Higher Education study programmes,** approved by Order No 1-01-162 of 20 December 2010 of the Director of the Centre for Quality Assessment in Higher Education (hereafter – SKVC).

The evaluation is intended to help higher education institutions to constantly improve their study programmes and to inform the public about the quality of studies.

The evaluation process consists of the main following stages: *1)* self-*evaluation and self-evaluation report prepared by Higher Education Institution (hereafter – HEI); 2) visit of the review team at the higher education institution; 3) production of the evaluation report by the review team and its publication; 4) follow-up activities.*

On the basis of external evaluation report of the study programme SKVC takes a decision to accredit study programme either for 6 years or for 3 years. If the programme evaluation is negative such a programme is not accredited.

The programme is **accredited for 6 years** if all evaluation areas are evaluated as "very good" (4 points) or "good" (3 points).

The programme is **accredited for 3 years** if none of the areas was evaluated as "unsatisfactory" (1 point) and at least one evaluation area was evaluated as "satisfactory" (2 points).

The programme **is not accredited** if at least one of evaluation areas was evaluated as "unsatisfactory" (1 point).

1.2. General

The Application documentation submitted by the HEI follows the outline recommended by the SKVC. Along with the self-evaluation report and annexes, the following additional documents have been provided by the HEI before, during and/or after the site-visit:

No.	Name of the document
1.	Results of the students surveys of the study programme

1.3. Background of the HEI/Faculty/Study field/ Additional information

Vilnius Gediminas Technical University (hereafter – VGTU) is a state higher school. It is formed by 10 faculties, which offer different studies (Bachelors and Masters) in the technical area.

The Bachelor programme in Production Engineering & Management is organized by the Faculty of Mechanics where, in majority, the professors are from the Department of Mechanical Engineering. This Department was created in 2013 as a merge of the previous Department of Management of Industrial Enterprises and the Department of Machine Engineering. The Faculty organises 5 more Masters and 3 Bachelors in the same study field: "Production and manufacturing engineering".

The Bachelor study program Production Management & Engineering is a first-cycle study oriented to academic and practical applications on the field of engineering solutions for design and manufacturing. In 2012, an International Group of Experts on behalf of the Lithuanian Centre conducted an external evaluation of the study programme for Quality Assessment in Higher Education (SKVC). As a result, the experts an unconditional accreditation for the programme, including the following four recommendations:

1. Revise the objective and learning outcomes in order to improve their coherence and exploit this work for identify potential improvement actions, also thanks to the involvement of the various stakeholders (data are already available and will be collected also in the future).
2. Explore the possibility to increase the ECTS number assigned to the Specialisation part (C1 "Specialization and students' choice subjects defined by the University" and C2 "Students' free choice study subjects") and/or to Professional Practices (B6: Cognitive Practice, Professional Practice 1, Professional Practice 2) to take into accounts the request stemming from graduates and employers.
3. Foster the development of problem-based learning and multidisciplinary and team projects, following the positive example of the complex project in innovation, which is appreciated by students.
4. Reinforce the importance of management subjects and complement the current software offer with industrial engineering IT (ERP system, PLM, PDM, etc.), to be also applied in study subjects.

1.4. The Review Team

The review team was completed according *Description of experts' recruitment*, approved by order No. 1-01-151 of Acting Director of the Centre for Quality Assessment in Higher Education. The team conducted the Review Visit to HEI on *7th December 2016.*

1. Prof. Marti Casadesus (team leader), *Full Professor, Department of Management, University of Girona, PhD in Industrial Engineering, Spain;*
2. Prof. Johan L. Malmqvist, *Chair Professor, Department of Product & Production Development, Dean of Education at Chalmers University of Technology, Göteborg, Sweden;*
3. Dr. Oluremi Olatunbosun *Head of Vehicle Dynamics Laboratory, School of Mechanical Engineering, University of Birmingham, United Kingdom;*
4. Dr. Vincas Benevičius, *director of the private limited liability company „Žali žali", Lithuania;*
5. Ms. Žiedūnė Sabaitytė, *student of Aleksandras Stulginskis University study programme Hydraulic Engineering, Lithuania;*

Evaluation coordinator – Ms. Ina Šeščilienė.

II. PROGRAMME ANALYSIS

2.1. Programme aims and learning outcomes

The programme has four stated **programme aims**: the first is related to creating a basis in mathematics, science and technology; the second relates to general methodological skills in the area; the third has to do with the knowledge related to the two specializations of the programme, i.e. Industrial technology and Industrial enterprise management; and finally the fourth has to do with innovation, using high technologies, to understand meaning and value of own solutions, and lifelong learning. It can be argued that the first three are sufficiently clear as well as relevant. However, the fourth is less clear and less coherent. For example: what is an "interest" in innovation or what are the high technologies that the graduates should be able to implement? Overall, however, the programme aims are **sufficiently clear and well defined**. They are also **publicly available**, in Lithuanian as well as English.

The learning outcomes are rooted in the EUR-ACE standards, and are thus related to internationally established **academic requirements** on bachelor programmes in engineering, although slightly differently organized and re-formulated. The re-formulations serve to "translate" the non-discipline-specific programme outcomes of EUR-ACE to programme outcomes suitable for the production engineering context. This is relevant and essential. However, a more structured and detailed account for the mapping between EUR-ACE outcomes and the current programme outcomes would have been desirable. Nevertheless, it can be assessed that the learning outcomes of the Production Engineering & Management programme have the scope and content that makes them **consistent with the type and level of studies and the level of qualifications offered**.

There is a **clear labour market need** for the graduates with the knowledge and skills as developed in the programme, as evidenced in employment data and confirmed in interviews with social partners.

There is a **good agreement between programme name, learning outcomes, contents and qualifications**. The compulsory part of the programme develops a solid basis in mechanical engineering and in production engineering. In the compulsory part, the programme contents cover the essential parts of the field of study. The specializations offer students to deepen their knowledge in either production engineering ("industrial technology") or production management ("industrial enterprise management").

2.2. Curriculum design

The structure of the programme comprises 240 ECTS during 4 years in full-time mode. It is delivered in Lithuanian. It is divided into 15 ECTS subjects of general university studies, 180 ECTS from the technological science area and the study field of production and manufacturing area and 45 ECTS for the specialization part. The maximum number of credits per year is 60 ECTS, with a maximum of 7 course units per semester. All subjects are at least of 3 ECTS. Consequently, the **curriculum design meets legal requirements**.

The technological science courses first provide a broad mechanical engineering background during the first two years of study. In the third year, the compulsory courses mainly cover the production management & engineering study field, including the two branches of specialization ("Industrial Technology" and "Industrial Enterprise Management"). There is logical progression of the knowledge within the field. The courses are **evenly spread out** and there is **no unnecessary repetition**.

The scope of the programme is clearly sufficient for addressing it main aims, concerning its first three aims (mathematics & science, methods, production engineering & management). The fourth aim (innovation, high technology) is less well represented in the programme, but is a minor aim. A mapping matrix is provided that shows that the courses address all programme learning outcomes. Overall, the **scope of the programme is sufficient to ensure learning outcomes**.

The course cards further document the specific learning outcomes of each course along with methods applied to teach and assess fulfilment of the intended learning outcomes. This is a good practice to show that **the content and methods of the subjects/modules are appropriate for the achievement of the intended learning outcomes**. However, this is not shown in a particularly clear way. One row in the related matrix in the course card can typically include one programme learning outcome, five course learning outcomes, eight teaching and learning methods and three assessment methods.

It cannot be fully concluded that the programme **reflects the latest achievements in science, art and technology**. It is difficult to see how hot topics such as sustainable production, industry 4.0, additive manufacturing, and big data (production) analytics are addressed in the programme. In a more basic level, robotics production system design and factory layout design seems to be a bit poorly included. At the same time, it can be debated if some of the subjects, for example "Corrosion and Protection" and "Machines of Energy Transformation" should be compulsory. A critical review of the curriculum is needed to open up space for introducing modern and emerging topics.

2.3. Teaching staff

The teaching staff of the programme **meets the legal requirements**: All of the lecturers of the study subjects have a scientific degree, and field of scientific activities of all of them complies with their taught study subjects. The self-assessment report shows that teaching staff members regularly update their professional competence.

The teaching staff has a **suitable age profile**, with a majority of staff members in the 31-50 year bracket. The programme has successfully carried out a generational change during the last years.

The **number of teaching staff** is high: On average, during the last 5 years, 68 teachers, out of which 11 professors and 30 associate professors, were involved in the teaching of the programme. This corresponds to a 1/2 ratio of university teachers/students, a very favourable number. However, the self-assessment accounts for the teaching staff numbers on an aggregate level. All mechanical engineering faculty members are counted as well as some teachers from other faculties. That makes it very hard to precisely assess what number of staff is competent for teaching in the specialized production engineering and management subjects. This summation of staff headcount confuses the computation of key factors. However, it would seem that the number is sufficient. According to the interviewed students, the teachers of the programme are well qualified and they have an excellent access to them.

VGTU creates **conditions for the professional development of the teaching staff** involved in the programme. For example, according to the SER, some academic staff has been participating in different courses organised by the University or has conducted internships in Lithuanian companies. However, according to the audiences, the staff could participate more in courses or training developed by the University or the Faculty such as teaching methodologies, languages, and dealing with the students, etc. In fact, a policy or plan for training in the Faculty and in the Department does not exist. Then, it would be relevant to stress the importance of

considering training that could increase the staff internationalization: traineeship at foreign studies, research at foreign research institutions, etc.

The teaching staff members are to some extent **involved in research** related to the programme. According to the SER, some of them have during the last 5 years participated in research conferences abroad, in research projects funded by the Lithuanian State Science and Studies Foundation, and in EU-funded project. Further, the SER states that a large number of teaching staff members have participated in other EU study projects not directly related to research, focused in general on the Lithuanian higher education sector. Some examples of research projects are listed. However, most of them are general mechanical engineering, with an unclear coupling to production engineering & management. It would be desirable with a higher number of production engineering research projects so as to secure that the faculty members have the most recent knowledge and skills and can keep to curriculum and courses up-to-date.

2.4. Facilities and learning resources

The programme is carried out at premises of the Faculty of Mechanics. The programme disposes sufficient spaces (auditoriums, laboratories, computer classes, common working classes etc) for the teaching process. According to the SER, the Faculty includes 26 premises with nearly 900 working-places. Their technical and hygienic conditions are good. The majority of the classrooms and laboratories have multimedia equipment. Facilities for co-working in student teams are limited. After the site visit, it is confirmed that the **premises** for studies are adequate both in their size and quality.

In general, the **teaching and learning equipment** (laboratory machining and computer equipment, consumables) are adequate for the programme. The 4 computer classrooms are sufficient and adequately equipped with updated software (Labview, AUTOCAD, Matlab etc) to allow students to work individually while there are no lessons taking place. The programme has at its disposal a large variety of manufacturing equipment ranging from parts manufacturing, measurement and joining. The machinery includes modern machines from HAAS (mini-mill) and Motoman (robot). Equipment used to teach assembly is however in need of upgrading. According to the student's audience, there are no problems related to the size and quality of the teaching equipment. In general, laboratories can be used anytime students need it.

Most students are able to find **practice** (internships) by their own, but if needed, the university offers help to find a position.

Teaching materials available in the Library (textbooks, books, scientific journals) are adequate and accessible. There is access to sufficient journals and e-books for developing the programme and further research in the field. However, it is necessary to increase the number of guides prepared by the teachers, considering the lack of literature in the speciality in Lithuanian. A good practice could be to encourage the use of e-books resources and, in general, all kinds of resources at the Library. At the same time, it will be interesting to encourage students to practice other languages during their learning process, especially important in this field.

The use of modern concepts and resources for digital learning is however limited. For example, the interviewed students claimed that that had not been exposed to blended learning, flipped classrooms or digital exams. Moodle is used in some subjects, but it is still not in the majority of subjects, and is used mainly to make material available and to manage student hand-ins. There is a need to improve the learning process of the students with these tools and resources.

2.5. Study process and students' performance assessment

The **admission requirements are well founded**: Admission requirements are based on high school with mathematics and physics factored in and are thus suitable for an engineering programme. However, the average score of admitted students seems to have sunk considerably during the last two years. Recently, some students with very low high school grades have been admitted to the programme. This poses a risk for a low graduation rate as well as for graduating students with less knowledge and skills than needed in the workplace. There is a need to have a new strategy and plan to increase the number and grades of enrolled students, and increase the motivation of the admitted students to avoid dropouts.

The organisation of the study process together with the distribution of the academic activities' load assures an **adequate provision of the programme learning outcomes.** The programme has increased the number of hours spent on practical exercises by 8 % (average for continual study). However, the interviewed students still requested more practical exercises, as well as more study visits to exhibitions and excursions to industrial companies. It will be necessary too, to include visiting professors to the courses sharing new trends in the industrial sector. Additionally, there is a need to expand the use of on-line learning platforms, such as Moodle, to all the courses.

The programme offers some **opportunities for students to participate in research, artistic and applied research activities**. Students can participate in scientific projects, as well as join thematic working groups, for example on intelligent materials, led by teachers. An annual Young Scientists conference and a journal provide opportunities for students to present and publish their results. Participation is voluntary.

VGTU has different ERASMUS+ agreements with HEIs in Europe, allowing students to **participate in student mobility programmes**. *Participation is however quite low,* varying between 0 and 4 % during 2011-2015, *although an increase can be seen during the last year.* Considering that the programme is in Lithuanian, no students from abroad have enrolled to the programme. The SER argues that efforts have been made to increase participation in exchange programmes, but there is still a need to increase the internationalization of the programme.

VGTU ensures an **adequate level of academic and social support**. The university provides student information sessions, career days, counselling from faculty, scholarships, and support for students with mobility disabilities. Moreover, students have access to the Students' Union and support to participate in sports, health care and culture activities. There is support too for the students from abroad (dormitories), and for the students with financial problems. During the audience with students, it was stated that they considered that the support from academics and students are in general excellent.

The description of the **assessment system of students' performance** is clear and adequate. They are announced at the beginning of the studies, and they appear at the descriptor of every subject, although it is not available on the website. The mark is calculated using the marks of the outcomes in the specific subject. In general, the student can only be admitted to the exam after completing term papers and projects. That methodology ensures the continuous work of the students during the course. Additionally, in the content cards of every subject, the relation between the expected learning outcomes, the teaching learning methods and the assessment methods is defined. The designed process for assessing the final work, by the bachelor degree granting committee, is clear and adequate.

The graduates from the programme are attractive on the labour market. Graduates find jobs within two months after graduation, and often within their speciality. According to the interviewed alumni, they were all satisfied with the employment that they get. The professional activities of the majority of **graduates thus meet the programme providers' expectations**.

2.6. Programme management

The **responsibilities for the implementation and monitoring** of the programme are clearly allocated: The Council of the Faculty is the decision-making body on new or updated programmes at the Faculty Level. Its proposal comes from the Study Committee Programme, which is the responsible for a settlement of problems of studies. This committee monitors and revises, annually, the structure and content of the programme. Members of the Study Committee are academics, one social partner and representatives of students. However, it is necessary to have a stronger leadership for the management of the programme, defining clearly who has the ultimate responsibility. The self-assessment report does not account for how financial responsibilities are delegated, e.g., for course development funding. In order to effectively develop the programme, the programme leadership needs to have such funds at its disposal. The staff members of the Department develop and improve the subjects of the study programme. They are revised for the period from 1 to 4 years. Although they are supposed to design the content of each subject considering the expected learning outcomes, the contents do not reflect exactly this relation. A further revision of the alignment of the subjects of the programme with the expected learning outcomes needs to be done.

Information and data for the assessment of the programme are collected periodically. This includes a periodic assessment of a student's polling at the end of the semester. In less formal ways, the students interact personally with the Department's staff in order to improve the programme. The students expressed trust in that the programme listened to their input and took action. The programme also collects informal data from its social partners. This is also done on a personal level. However the obtained data are not published (in an aggregate way), and the students do not receive any feedback of the results and the actions taken. It is needed that all the stakeholders receive some feedback of any action carried out using their opinions.

The **outcome of the previous external evaluation** (2012) has been used for the improvement of the programme. The programme has acted on a most of the issues that were identified during the last external evaluation.

Stakeholders, basically graduates and employers, are involved in the assessment and improvement of programmes. There is a regular involvement for social partners in the programme, both in operations and in evaluation and improvement. The programme has a good external network to ensure the continuity of such collaboration. For example, one of the social partners is a member of the study Programme Committee and, together with a representative of the students, participates in assessing the programme. However, according to the audience with the employers, the social partners would like to participate more actively in the improvement process of the programme. A formal and a systematic way to gather the interest of many social partners, not only one representative, are needed. They would like to participate more on the definition of the curriculum of the programme, and to suggest some of the contents of some subjects. Specifically, the stakeholder argued for the importance of making modern equipment to be available to students, and for a suitable inclusion of product, process and business innovation in the programme.

About the **internal quality management system**, the University has implemented ISO 9001 as quality management system. However, there are still some essential processes in an internal quality management system to be efficiently implemented, for example: measuring graduates and employee's satisfaction, or managing public information. Consequently there is a need to improve the public information of the programme (course cards, indicators,). Especially, it is needed to implement the processes for improving the programme, including actions plans (actions, responsibilities, timeline etc).

III. RECOMMENDATIONS

1. Develop a systematic approach to update the programme learning outcomes and content with consideration of emerging new production technologies.

2. Strengthen the role of the programme chair/lead. This person should have the responsibility, mandate and resources to drive the continued development of the programme.

3. Expand the use of digital, on-line, earning platforms to all subjects.

4. Deploy and follow up the strategy for increasing the recruitment of new students, considering their high employability and the current low number of new students.

5. Improve the information on the website, especially those related to the course cards and summary of the staff CVs.

6. Increase the internationalization of the staff, in teaching and in research. Increase the number of interchanges with other European Universities (Erasmus Programme for teachers) and increasing the international impact of the research (projects and publications) is needed.

7. Increase the number of hours spent on practical exercises
8. Include some study visits and visits to exhibitions on the programme.
9. Include some visiting professors or professionals in the courses.
10. Formalize the relations with employers in a framework for gathering data, analysing and improving the programme periodically.

IV. SUMMARY

The main strengths and weakness of the bachelor programme in *Production Engineering and Management at VGTU, according to each one of the analysed standards, are presented in the Summary.*

Evaluation area "Programme aims and learning outcomes".
The strength of programme is that it addresses the needs of industrial companies of the region and its graduates are very likely to find employment. Its aims are comparable to similar programmes in Lithuania and all around the world. It prepares for engineering roles in the Lithuanian industry. Learning outcomes are, in general, derived from EUR-ACE specifications, validating the programme to international standards.
The weakness of the programme is that programme and course learning outcomes related to some modern production engineering technologies and methods are lacking, including additive manufacturing, industry 4.0 and production data analytics.

Evaluation area "Curriculum design".
The strength of programme is that curriculum is in general appropriate, focused on the main issues in the production engineering & management field. It includes an adequate balance between theory and practice.
The weakness of the programme is that some modern production engineering topics, as listed above, are lacking.

Evaluation area "Teaching staff".
The strength of programme is that all teachers are well qualified, sufficiently experienced and meet the qualification requirements to execute the production engineering & management programme. The relation between teaching staff and students, alumni and social partners is excellent.
The weakness of the programme is a low internationalisation of staff - low participation in research projects and low impact of their research internationally (not local).

Evaluation area "Facilities and learning resources".
The strength of programme is that the facilities (classrooms, laboratories and computer classrooms) are adequate for a production engineering & management programme. Students have a good access and services of the library. Students have good access to up-to-date computer software for the programme.
The weakness of the programme is that the use of on-line learning platforms is basic, including limited adaptation of recent developments in the area, such as blended learning.

Evaluation area "Study process and student assessment".
The strength of programme is that the admission requirements to the study programme are adequate. The employment rate of the graduates is very high. In general, the satisfaction of the students with the teaching methodologies and subjects' assessment is very high.
The weakness of the programme is that there is a lack of study visits during the studies. There is a need to expand the use of on-line learning platforms to all subjects. In order to increase the international outlook of the programme's graduates, it is needed it to increase the number of international exchanges of students and the participation of visiting professors in the courses.

Evaluation area "Programme management".
The strengths of programme are that there is a clear definition of the responsibilities of the management of the programme and the role of the Study Programme Committee, there is a

working system for gathering the opinion periodically of the students in the programme and there is a very good informal cooperation with social partners.

The weakness of the programme is that the programme needs a stronger leadership for the management of the programme. There is a need to formalise the relations with industry analysing formally their needs and trends. In order to continuously improve the programme, it is detected a lack in the actions plans for improvement, including the definition of responsibilities and timeline.

V. GENERAL ASSESSMENT

The study programme *Production Engineering and Management* (state code – 612H77001) at Vilnius Gediminas Technical University is given **positive** evaluation.

Study programme assessment in points by evaluation areas.

No.	Evaluation Area	Evaluation of an area in points*
1.	Programme aims and learning outcomes	3
2.	Curriculum design	3
3.	Teaching staff	3
4.	Facilities and learning resources	3
5.	Study process and students' performance assessment	3
6.	Programme management	3
	Total:	**18**

*1 (unsatisfactory) - there are essential shortcomings that must be eliminated;
2 (satisfactory) - meets the established minimum requirements, needs improvement;
3 (good) - the field develops systematically, has distinctive features;
4 (very good) - the field is exceptionally good.

Grupės vadovas: Team leader:	Prof. Marti Casadesus
Grupės nariai: Team members:	Prof. Johan L. Malmqvist
	Dr. Oluremi Olatunbosun
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	Ms. Žiedūnė Sabaitytė